

FT
MEADE

QE 816
.P12
Copy 1

NATIONAL ACADEMY OF SCIENCES.

VOL. III.

FIFTEENTH MEMOIR.

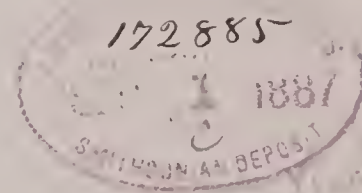
ON THE SYNCARIDA, A HITHERTO UNDESCRIBED SYNTHETIC GROUP
OF EXTINCT MALACOSTRACOUS CRUSTACEA.

NATIONAL ACADEMY OF SCIENCES.

VOL. III.

FIFTEENTH MEMOIR.

ON THE SYNCARIDA, A HITHERTO UNDESCRIBED SYNTHETIC GROUP
OF EXTINCT MALACOSTRACOUS CRUSTACEA.



I.—ON THE SYNCARIDA, A HITHERTO UNDESCRIBED SYNTHETIC GROUP OF EXTINCT MALACOSTRACOUS CRUSTACEA. PLS. I, II.

READ APRIL 21, 1885.

BY A. S. PACKARD.

For a long time I have been desirous of examining into the relationship of the singular group of Carboniferous Crustacea represented by the genus *Acanthotelson* of Messrs. Meek and Worthen, as it has seemed to be a remarkable connecting link between the Edriophthalmata (or Tetradeapoda) and the Decapoda (in the older sense). An unexpected opportunity has been offered in a large series of specimens, which, without solicitation on my part, has been generously offered me by R. D. Lacoe, esq., of Pittston, Pa., and J. C. Carr, esq., of Morris, Ill. Mr. Lacoe's collection was a very rich one, comprising over forty nodules, each containing a usually well-preserved *Acanthotelson*. Although additional specimens are much to be desired, especially such as may show the eyes and their nature, whether sessile or stalked, a point still unknown, the eyes not having been with certainty identified, and also to better show the nature of the abdominal appendages, it seems to us that enough characters have been preserved to allow us to present a tolerably accurate account of the essential features of the group.

The genus *Acanthotelson* was first proposed by Messrs. Meek and Worthen, in 1860,¹ and the species described as *A. stimpsoni* M. & W. A second species, *A. eveni*, was described by the same authors in 1868.² Additional facts were stated and figures given in the Report of the Geological Survey of Illinois, III, Paleontology, 1868. The specimens we possess enable us to amend and to add to their original descriptions; but in doing so we wish to bear witness to the care and ability displayed by the authors in the examination and illustrations of this form. The genus is referred with doubt by the authors to the Isopoda, who also refer to its resemblance to some of the lower types of macroural Decapods. They remark: "From all the specimens of this genus now known it is evident that, in the nature of its antennæ, as well as in the forward direction of all its thoracic legs, and to some extent even in the nature of its caudal appendages, it differs from the Tetradeapoda, and approaches some of the lower types of the macroural Decapoda. In the possession of seven distinct thoracic segments, without a carapax, however, as well as in the form of all its thoracic and abdominal segments, it agrees with the Tetradeapoda, particularly with the Isopoda, which have but one pair of the abdominal appendages styliform, instead of three, as in the Amphipoda. One specimen of *A. stimpsoni* (represented by fig. B, p. 549) also appears to show the eyes (marked I in the cut) to be sessile, though remarkably prominent. If they are sessile, this must be conclusive evidence that it must be a Tetradeapod. Until other examples, showing more clearly the nature of its eyes and some other parts, can be examined, we leave it provisionally where we first placed it with doubt, in the Isopod group of the Tetradeapoda." (P. 550.)

The following description, while embracing the more general characteristics of the group to

¹ Proceedings Academy of Natural Sciences, Philadelphia.

² Amer. Journ. Sc., 2d ser., xlv, 28, 1868.

which *Acanthotelson* belongs, also without doubt comprises the generic and specific characters. We will first give a description of the fossils themselves, based on the material we have had for examination, and then endeavor to point out those characters which we suppose to be the essential features of the group to which the genus belongs, and also to indicate the probable affinities to the other divisions or suborders of Malacostraea. It may be as well to say that, after examining some forty specimens, we are unable to distinguish between *Acanthotelson stimpsoni* and *eveni*, and are inclined to believe that the former is the young of the latter species.

In Mr. Lacoe's No. 501b the head is well preserved; the first arthromere or segment is considerably shorter than any of the succeeding ones; it is slightly less than two-thirds as long as the succeeding arthromere; it bears in front a well-marked, small, triangular rostrum, which is acute at the tip, and is about two-thirds as long as the segment itself; the edge of the rostrum is considerably raised, especially at the base. The front edge of the segment on each side of the rostrum is also margined with an elevated ridge. The surface of the segment is rather full and convex on each side, but not so decidedly so as the second segment. The second arthromere is about as long as those succeeding, though not quite so long as the sixth arthromere; on each side is a low boss-like swelling, situated obliquely, and prolonged in an oblique direction to the anterior outer edge. The second segment is distinctly separated by an impressed line from the first, but there is not a true articulation between them, so that the first and second cephalic segments may be said to be consolidated and to represent the carapace of the Schizopoda. The three succeeding segments have a transverse, uninterrupted, smooth ridge situated in the middle on the third, but in the fifth segment near the hind margin. The sixth and succeeding segments are smooth and even. The body is of even width to near the telson. The lower edges of the segments are evenly rounded, those of the hinder abdominal segments are more acutely rounded.

We have been unable to detect any positive traces of the eyes, nor can we state whether they were sessile or stalked, though if they were present and sessile we do not see why they should not have been preserved in some of the specimens (particularly 501^a and 406^a).¹

The first pair of antennae seem to arise directly from each side of the small, short, rudimentary rostrum. The scape is three-jointed, and not very long and slender; second joint not so thick, and about one-fourth shorter than the first and twice as long as thick; third joint long and slender, considerably longer than the second. The scape bears two flagella, which are long, slender, multiarticulate branches of unequal length, of which the inner is the thicker and shorter, the outer flagellum much slenderer and longer, the entire length of the antennae being one-half that of the second or outer pair. The second pair of antennae have also a three-jointed scape (which is not accurately represented in Meek and Worthen's figure). The basal joint is short; second joint shorter than the first, with two unequal internal spines; third joint slightly longer than the second and much smaller; there are traces of a small antennal scale; the flagellum is long and slender, its entire length about half that of the body.

There are twelve pairs of feet (506^{a,c}), a pair to each segment situated between the head and penultimate uromere or abdominal segment; these, with the caudal pair of appendages, make in all thirteen pairs of legs.

The number of arthromeres or body-segments is sixteen, counting the head as consisting of two when seen from above, and the telson as a rudimentary arthromere, so that there are thirteen arthromeres between the head and telson, each of them bearing legs. There is no apparent distinction, as regards the segments themselves, into cephalothorax and abdomen (urosome), but there are two cephalic, nine thoracic segments, and seven abdominal, counting the telson as the seventh. The first seven pairs of (thoracic) legs are much alike in appearance, reminding us of those of *Petalophthalmus* and *Gnathophausia*; these are succeeded by five pairs of abdominal appendages, which are about half as long and large as the thoracic legs. The first pair of thoracic legs (which do not seem to be mandibular palpi) are considerably larger (broader and longer) than the succeeding ones. It is composed of six joints; the first and second rather narrow; the third broad, with, according to Meek and Worthen, "three" spines on the "under side" (these were not to be seen in my specimens, though undoubtedly existing there); fourth longer than the third, with three spines;

¹ Before going to press I received from Mr. Lacoe a very large specimen, his No. χ^1 , in which are two large smooth concavities, one on each side of the base of the head; it is possible that these are sessile eyes.

fifth joint thicker than the fourth, thickening towards the distal end, with four spines, the fourth spine the largest and as long as the joint is thick; the sixth about two-thirds as thick as the fifth, with two remote spines on the under side and ending in two spines, one of them very large and stout (there is possibly a third small spine). In Meek and Worthen's figures the spines are erroneously drawn on the outer side of four joints; we find that the spines are situated only on the two penultimate joints; the terminal claw is not represented by Meek and Worthen. The succeeding six pairs are all about the same size and length, being large, well developed, long, and slender, about one-half to two-thirds as thick as the first pair (406^b), with no traces of a gill; the second pair are a little stouter than the others and apparently spined on the penultimate joint; the seventh pair the slenderest and nearly as long as the first pair; the three basal joints are long and slender, the third very distinct, long, and slender; fourth joint long, slightly swollen in the middle; fifth equal to the sixth in length, but slender, slightly thickened towards the distal end; the sixth somewhat longer than the fifth, ending in a point; none of the terminal joints appear to be chelate.

The abdominal appendages are distinctly biramous and schizopodal in their appearance. Each apparently consists of a small, narrow, jointed limb and a larger exopodital branch (or gill(?); see 406^{a,b}). We can see traces of the first two pairs. In another specimen (501^{a,b}) the first three pairs of abdominal legs are to be plainly seen; the exopodital or respiratory and swimming ramus is sessile, lanceolate-oval, and broad, thickened on the hinder (?) edge. In Mr. Carr's specimen No. 1 are distinct traces of a biramous appendage on the fourteenth and fifteenth (penultimate) segments; and in his No. 3 there are to be seen the traces of the second-fourth pairs of abdominal feet, with double rami, the hinder ramus the smaller and narrower. In an abdominal foot (in Lacoe's No. 406^{b,g}) the second joint is narrow, lanceolate-oval, rounded at the tip, from which arise a series of long slender setæ, about twelve in number, which form an oar-like appendage equaling in size the basal joint; total length of the limb 14.5^{mm} (the basal joint 8^{mm}, the row of setæ 6.5^{mm}=14.5^{mm}). These legs remind us somewhat of those of *Squilla*, as do the first thoracic pair, from their being larger than the others and armed on the under side with stout spines.

The telson is very long and slender, narrow, acute, the end very slender, with long setæ on each end; it is a little longer than the caudal feet (uropoda) on each side of it. The caudal feet, or sixth pair of uropoda, are divided into two long, large, acute rami (endopodite and exopodite) arising from a small, short basal joint (Carr's No. 1). The two rami are of nearly the same size and length, both edges of each branch being setose (the setæ are not so numerous and close as represented in Meek and Worthen's figure).

Of forty specimens examined, the total length of the largest example, including the caudal appendages, but not including the antennæ, was 75^{mm} (Lacoe's No. 58^{mm}); another still larger (No. χ^4) was 85^{mm} in length; a specimen received from Mr. Carr was 58^{mm} in length.

In a specimen of *A. eveni*, 45^{mm} in length, I made the following measurements: Width of the body, 6-7^{mm} (in Lacoe's 501^b: Width of first cephalic segment, 5.5^{mm}; of second segment, 6^{mm}; length of first and second head-segments together, 6^{mm}; length of rostrum, 1^{mm}; length of sixth segment, 3.5^{mm}; length of first antennæ, about 12^{mm}; length of second antennæ, 26^{mm}; length of first pair of feet, 20^{mm}; greatest width of fifth joint of first feet, 2^{mm}; length of abdominal feet, 18-19^{mm}; length of telson, 13^{mm}; length of caudal appendages, 12^{mm}.

Many of the specimens are preserved flattened out, showing the back, with the legs spread out symmetrically on each side; others are preserved lying on their side, with the body somewhat arched, and then they present a shrimp-like appearance, though on a superficial examination reminding one of an Amphipod lying on its side.

The foregoing remarks apply to the larger specimens described by Meek and Worthen as *Acanthotelson eveni*. I cannot with certainty point out any distinctions from *A. stimpsoni* M. & W., the first-described species; the smaller specimens, which might be referred to the latter species, are evidently the young of *A. eveni* M. and W. Hence the specific name should be *Stimpsoni*.

The characters of this Crustacean are such as to forbid our referring it to any known group; we therefore suggest that it forms the type of a suborder of thoracostracous Crustacea, which we would designate as the Syncarida.

What we should regard as the differential characters of the group Syncarida, to which *Acantho-*

telson belongs, are the sixteen free segments of the body, which are homonomous or of uniform size, the first and second, however, being soldered together; the absence of a true earapace; the seven pairs of schizopod-like legs, the first pair spined and raptorial, slightly reminding one of those of *Squilla*; the second pair also spined; the antennæ of both pairs are long and slender, the two flagella of the first pair being very unlike any sessile-eyed or edriophthalmatous Crustacean; the six pairs of abdominal feet, which are long, slender, and with a general resemblance to those of the Schizopoda; the broader, oar-like swimming ramus, ending in long setæ. Any doubts as to the maerouran affinities of the Syncarida are removed by an examination of the long, acute telson and last pair of abdominal appendages; the appendages are biramous, the divisions flattened from above downwards, so that they with the telson serve, as in schizopods and shrimps, for propelling the body backwards when the animal is disturbed.

We should regard the Syncarida as the lowest group or suborder of Thoracostraca, but much nearer the Schizopoda than the Cumacea; they form a connecting link between the Amphipoda and Thoracostraca, but at the same time in their most essential characters stand much nearer to the Schizopoda than the Amphipoda; the lack of a earapace, even a rudimentary one, and the homonomous segmentation, causing them to bear a resemblance to the Edriophthalma, which they would not otherwise present. The Syncarida may be regarded as the homotaxial equivalents of the Decapoda, Schizopoda, or Stomapoda. To the Isopoda, *Acanthotelson* presents a superficial resemblance, due to the slightly vertically compressed body and the homonomous segmentation. The Edriophthalma (*Arthrostraca* of some late authors) are defined by Claus as "Malacostraca with lateral sessile eyes, usually with seven, more rarely with six or fewer separate thoracic segments, and the same number of pairs of legs, without a earapace," but this definition does not express those differences in the form of the antennæ, the thoracic legs, and abdominal appendages, especially those of the end of the urosome or abdomen, which are characteristic of the sessile-eyed Crustacea as distinguished from the Thoracostraca.

From the Isopoda, in which the body is usually broad and vertically flattened, with seven free thoracic segments, while the abdominal legs are lamellar and closely appressed to the short abdomen, our *Acanthotelson* plainly differs in the long bi-flagellate Decapod-like first antennæ, in the long homonomous segments of the abdomen, and the schizopodal abdominal feet, and especially the Schizopod-like telson and last pair of feet, adapted, as in the shrimps, for striking the water from above downwards.

The Amphipoda are, in general, characterized by their laterally compressed body, with lamellate gills on the thoracic feet, and an elongated abdomen, of which the three anterior segments bear the swimming feet, while the three posterior bear posteriorly-directed feet, adapted for springing (Claus). Now, if *Acanthotelson* is not an Isopod, still less should it be regarded as related to the Amphipoda. The first antennæ are entirely unlike those of any known Amphipods, the latter having a very short accessory flagellum; the second antennæ of *Acanthotelson* are strictly decapodous in appearance and very different from those of the Amphipoda, whereas in *Gammarus* the scape is as long as the flabellum. Although there are seven free thoracic segments in *Acanthotelson* as well as in *Gammarus* and other Amphipoda, those of *Acanthotelson* are not compressed any more than in the Schizopoda, and there are no traces of epimera; on the contrary, the free edges of the thoracic and abdominal segments are much as in the Schizopoda and Caridea. The thoracic appendages of *Acanthotelson* are, on the whole, like those of the Stomapoda and Schizopoda. We cannot detect any traces of mouth-parts, mandibles with their palpus, or maxillæ; but the thoracic legs do not present any close resemblance to those of the Amphipoda, the first pair being as much, if not more, like those of *Squilla* than any Amphipod with which we are acquainted, while the three posterior pairs, which are in form and size like those in front, entirely differ from those of *Gammarus* and most other normal Amphipods, in which the basal joint is very large and triangular. Turning to the abdomen, the difference in that of *Acanthotelson* from that of the Amphipods is still more marked. The first five pairs of uropoda, or abdominal appendages, are, in *Acanthotelson*, all formed apparently on the same plan, not essentially different from those of Schizopods, while the last pair are flat and on the same plane as the telson and intimately associated with the latter; in short, these parts are formed on a truly macrurous plan and most approach those of the Schizopods, in which the telson and rami of the last pair of feet are narrow and more

or less acute at the end. There is nothing in the structure of the urosome and its uropoda in *Acanthotelson* to remind us of the same parts in the Amphipoda.

Excluded from the sessile-eyed Crustacea, and forced to place *Acanthotelson* in the Thoracostraca, we are confronted by the lack of a carapace and the homonomous segmentation of the body. These are essential fundamental characters, but still the nature of the appendages and telson is such as to forbid us from rejecting the Syncarida from the ordinal limits of the Thoracostraca. We are compelled, therefore, to regard the group as a snborder standing near or at the base of the Thoracostraca, not far from the Stomapoda and Schizopoda, and with appendages closely homologous with those of these two groups. The Syncarida, from their lack of a carapace, and from the well-formed dorsal arch of the seven thoracic segments, we are obliged to consider as an annectant or synthetic group, pointing to the existence of some extinct group which may have still more closely connected the sessile-eyed and stalked-eyed Crustacea.

NOTICE OF ACANTHOTELSON ? MAGISTER (n. sp.).

Pl. II, Figs. 4, 5.

I have received from Mr. J. C. Carr, for examination, a specimen from Mazon Creek, collected at the same place as the nodules containing the *Acanthotelson*, showing the remains of a crustacean closely similar to, if not generically identical with *Acanthotelson*. Unfortunately the head and antennæ are not preserved sufficiently well for description, so that the following account should be regarded as provisional, until better-preserved specimens are found. As seen by the photograph (Pl. II, figs. 4, 5), the animal was of the same general shape as in *Acanthotelson*; when it died the body was curved on itself, so that the two longer antennæ crossed the end of the abdomen with its appendages. The abdomen in its dorsal aspect, with the telson and last pair of uropoda, are tolerably well preserved. The faint traces of the head, unless we are mistaken, show that it was of the same general shape as in *Acanthotelson*. There are traces of two pairs of antennæ; one fragment, the innermost, showing traces of six joints; and there are faint impressions, not showing the joints, of two long antennæ, which are about half as long as the body. There are no traces of any thoracic or abdominal appendages except the last pair of uropoda.

Description.—Body very broad, being nearly twice as broad as the largest *Acanthotelson eveni*, M. & W. The penultimate abdominal segment is a little more than one-half as long as the terminal segment. The last segment is very large and square, the sides nearly even, not narrowing posteriorly, and it is the broad square shape of this segment which will readily enable one to separate it from the previously described species of *Acanthotelson*. The telson is stout, broad at the base, and rather short, much shorter than the uropoda appended to the same segment. The terminal uropoda are broad and stout, with no traces of setæ. The basal joint is broad, triangular, but a little longer than broad; the outer ramus is of moderate length, ensiform, and slightly longer than the telson; there is only a fragment of the inner telson left in the fossil, which, however, shows that it was considerably narrower and smaller than the outer pair.

Probable length of the whole body, not including the antennæ or telson, 70^{mm}.

Length of penultimate abdominal segment, 5^{mm}.

Breadth of penultimate abdominal segment, 12^{mm}.

Length of terminal abdominal segment, 10^{mm}.

Breadth of terminal abdominal segment, 11^{mm}.

Length of telson, 10^{mm}; breadth at base, 2^{mm}.

Length of basal joint of last pair of uropoda, 4^{mm}; breadth, 3.5^{mm}.

Length of outer ramus of last uropod, 11^{mm}; breadth, 2^{mm}.

Explanation of Plate I.

Fig. 1. *Acanthotelson stimpsoni* M. & W., restored, enlarged twice.

Fig. 1a. *Acanthotelson stimpsoni* M. & W., head and antennæ seen from above, enlarged twice.

Fig. 1b. *Acanthotelson stimpsoni* M. & W., first thoracic leg $\times \frac{1}{2}$.

Fig. 1c. *Acanthotelson stimpsoni* M. & W., sixth thoracic leg $\times \frac{1}{2}$.

Fig. 1d. *Acanthotelson stimpsoni* M. & W., telson and last pair of uropoda $\times \frac{1}{2}$.

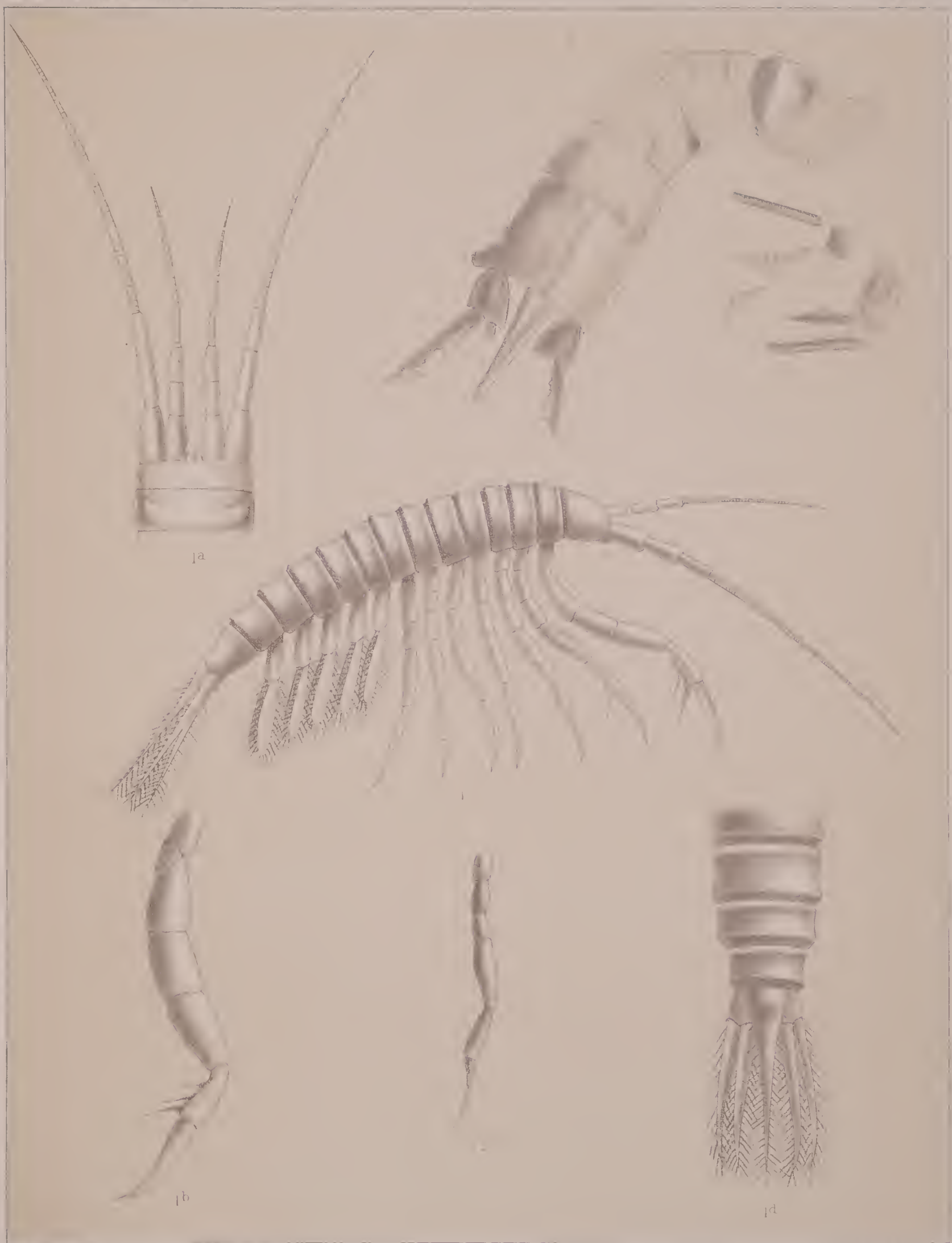
Fig. 2. *Acanthotelson ? magister* Pack., $\times \frac{1}{2}$. All the figures drawn by Dr. J. S. Kingsley.

Explanation of Plate I.

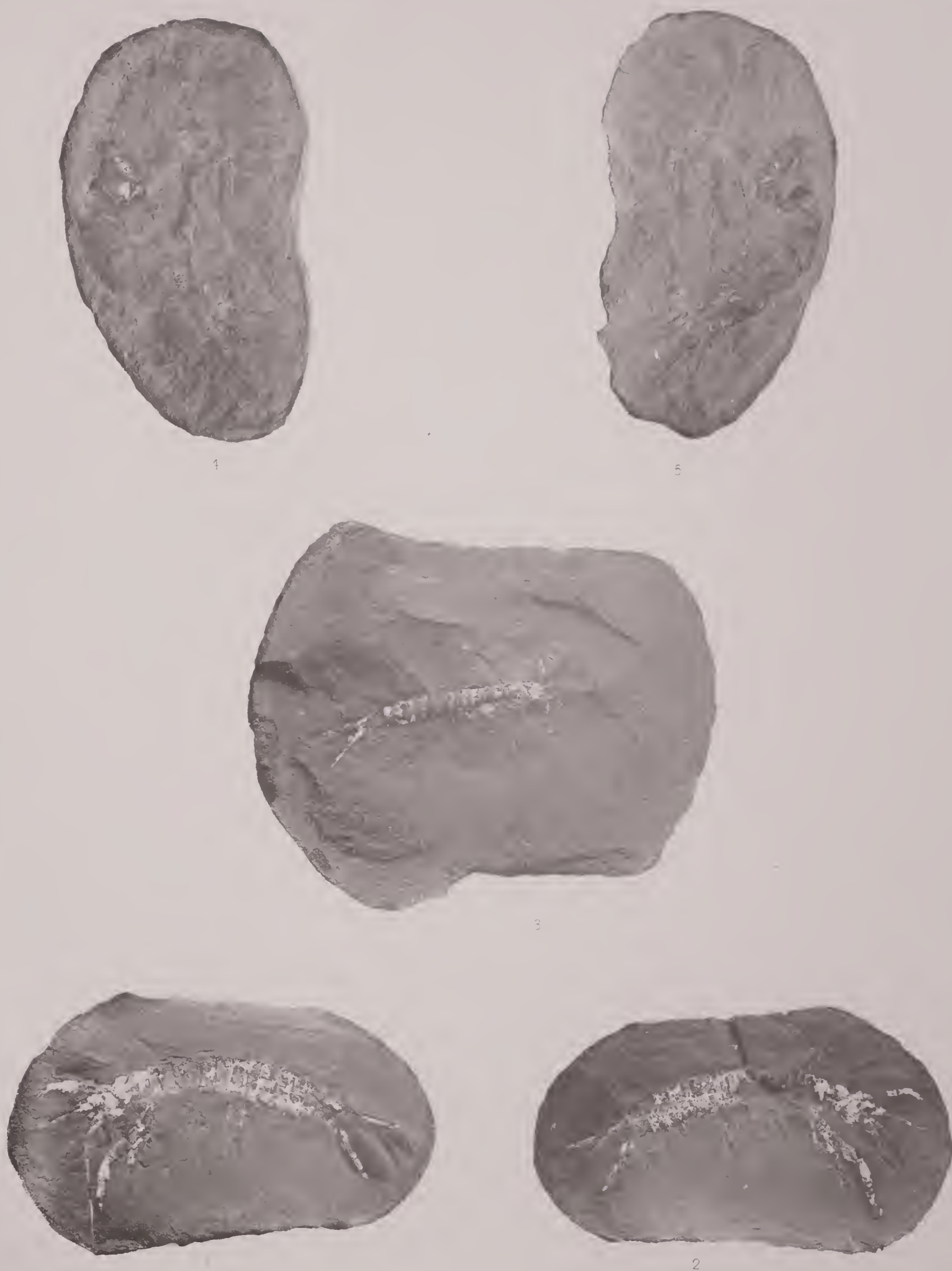
- Fig. 1. *Acanthotelson stimpsoni* M. & W.
Fig. 2. *Acanthotelson stimpsoni* M. & W., reverse of fig. 1.
Fig. 3. *Acanthotelson stimpsoni* M. & W.
Fig. 4. *Acanthotelson ? magister* Pack.
Fig. 5. *Acanthotelson ? magister* Pack., reverse of fig. 4.

From photographs taken by Mr. Robert L. P. Mason.

Note on an additional specimen.—Since this memoir was sent to the printer I have received a larger specimen from Mr. Lacoe, labelled “Braidwood, Ill., Q¹”, which, exclusive of the antennæ and telson, measures about 82^{mm}. There are traces of four pairs of thoracic feet which are long and slender and bent backwards from the head, reminding us of the four hinder legs of an ordinary shrimp seen from one side. There are traces of the antennæ, better preserved than in the original specimen. There appear to be a pair of large antennæ, the scape composed of three large joints, the second and third smaller and together equalling in length the basal joint; these antennæ appear each to bear a large antennal scale, resembling those of the *Maerura*, and reaching as far as the middle of the third antennal joint. The characters shown by this specimen lead me to refer it to a genus distinct from *Acanthotelson*, for which the name *Belotelson* (the entire name, *Belotelson magister*) is proposed. Additional specimens are much desired to complete our knowledge of its affinities.



FIGS 1-4. A. CRUSTACEAN. STIMPSON. 1891. MAGN. 100.



FIGS 1 — 3. ACANTHOTELSON STIMPSONI; 4. 5. A? MAGISTER

II.—ON THE GAMPSONYCHIDÆ, AN UNDESCRIBED FAMILY OF FOSSIL SCHIZOPOD CRUSTACEA. PL. III, FIGS. 1-4; VII, FIGS. 1, 2.

READ APRIL 21, 1855.

By A. S. PACKARD.

The opportunity of examining at my leisure about a dozen specimens of *Palæocaris typus* of Meek and Worthen, kindly afforded me by Messrs. R. D. Lacoe and J. C. Carr, has enabled me to work out some characters of this genus not mentioned by the original describers. The study of these specimens has induced me to compare the genus with *Gampsonyx*, and the result has led to the formation of a family or higher group for the genera, which should probably stand at the base of the Schizopoda, while also serving to bridge over the chasm existing between the Thoracostracous suborders, Syncarida and Schizopoda.¹

Palæocaris was first described by Messrs. Meek and Worthen, in the Proceedings of the Academy of Natural Sciences of Philadelphia (1865, p. 48), from specimens occurring in clay-stone concretions in the lower part of the true coal measures, at Mazon Creek, Morris, Grundy County, Illinois. Afterwards, in the third volume of the Reports of the Geological Survey of Illinois, 1868, the same authors figured the fossil, and expressed themselves as follows regarding its affinities: "Hence it would seem to present something of a combination of decapod (macrouran) and tetradecapod characters. That is, it possesses the candal appendages, anteriorly directed thoracic legs, the antennæ (some of the specimens appear, also, to show basal scales to the outer antennæ) and general aspect of a macrouran, with the distinct head, divided thorax (without a carapace), and seven pairs of thoracic legs, of a tetradecapod. We have not been able to see its eyes, but from its other decapod characters, and its analogy to *Gampsonyx*, which is said by von Meyer to have pedunculated, or at any rate movable, eyes, we are strongly inclined to believe that our fossil will be found to agree with *Gampsonyx* in this character also.

"It therefore became a matter of interest to determine to which of the subclasses, Decapoda or Tetradeapoda, it really belongs. That it belongs rather near *Gampsonyx*, though not to the same subordinate section (Schizopoda), there can be little doubt. Hence these two forms apparently fall naturally into the same family. Professors Jordan and von Meyer seem to have regarded *Gampsonyx* as a Tetradeapod, connected with the Amphipoda, but also possessing macroural decapod affinities. Professor Dana, however, regards it as a low type of Macrura, belonging to the section Schizopoda. He and Dr. Stimpson, to whom we sent sketches of our better specimens of *Palæocaris*, concur in the opinion, judging from all its characters yet known, that it is a low embryonic type of the Macrura, in which the carapace is not developed.

¹ We have not seen Burmeister's memoir "Ueber Gampsonychus" (Abh. d. naturf. Ges. in Halle, ii, 191, 1855), but Zittel (Handbuch der Palæontologie, p. 670) quotes Burmeister as stating that he regarded it "as the representative of a special group of Crustacea, which unites in itself some of the most essential features in the organization of the Stomapoda and Amphipoda."

"Generically, it is separated from *Gampsonyx*, figures of which (cuts C and D) we have added for comparison, not only in the nature of its caudal appendages, but in the more important character of having its thoracic legs simple, and not bifid, as in the *Schizopoda*."

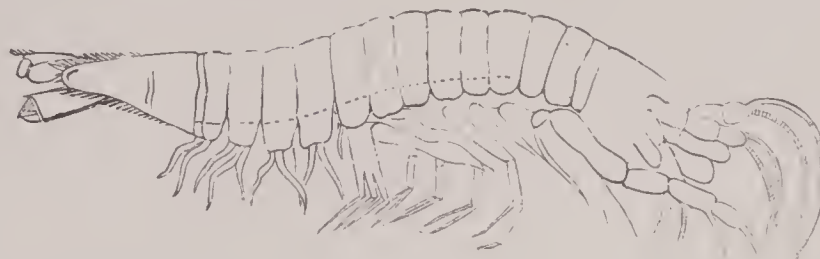


FIG. 1.—*Gampsonyx fimbriatus*. After Jordan and von Meyer. From Meek and Worthen.

We will now describe in detail *Palæocaris typus*, restoring it so far as possible in our description from the specimens received from Messrs. Lacoe and Carr, amounting in all to about a dozen, of which ten were kindly loaned by Mr. Lacoe. Dr. Kingsley has also obligingly drawn a restoration of the fossil from the specimens sent him for the purpose. There are no traces of a carapace, but the head is plainly distinct from the rest of the body. It is rounded in front, with no traces in my specimens of a rostrum, and is apparently composed of two segments. The body, seen sidewise, is suddenly arched or bent at the articulation of the thoracic and abdominal regions, as in stomapods and shrimps, and of the usual proportions. All the segments behind the head are free, and are fourteen (seven of which are abdominal) in number, counting the telson as one. There are thus sixteen segments, the head composed of two, the thorax of seven, and the abdomen of seven. The body thus has apparently the same number of thoracic and abdominal segments as in the existing Stomapoda. It is probable that the head of *Palæocaris* is composed of the same number of segments as in the *Schizopoda*, but as the mouth parts have not been preserved, this point must remain undetermined. The thorax, in its general shape, as seen from above, is of the normal shape, as seen in existing Stomapoda. The abdomen is much narrower than the thorax, with the basal segments short, and the penultimate one longer than broad, widening out a little on the hind margin, and excavated behind to receive the base of the telson.

The first antennæ are about one-half as long as the body, with the scape long and slender, three-jointed (unless what I regard as the basal joint consists, as appearances suggest, of two); first joint long and slender; second, as thick but only one-half as long as the first; third, moderately long, considerably longer than the second; flagella nearly equal in size, long and slender.

The second antennæ with the scape three-jointed, the basal joint long; second and third, of nearly the same size and length; flagellum thick at base, long and slender, entire antenna nearly half as long as the body of the animal.

Of the thoracic feet, six pairs can be detected, while in front of the first pair are two other appendages like the legs, but whether they are gnathopods, like those of other *Schizopoda*, or thoracic feet, it is difficult to judge. Each thoracic foot is long and slender, the three distal joints forming the greater part of the limb. The terminal (seventh?) joint is very long and slender, and probably ends in a single claw. The penultimate joint is about two-thirds as long as the terminal. It is thickened towards the end, and is perhaps a little shorter than the third joint from the end.

The endopodites* are distinctly preserved; those on the last four pairs of legs are long, narrow, lanceolate-oval, acute at the end, each side of the endopodites being alike, *i. e.*, one not being more convex than the other. If extended, the endopodite would reach out to near the middle of the terminal joint of the limb. I think I can detect eight pairs of endopodites—six at least—one on each thoracic leg and one on each of the gnathopods, if such they are. This would tend to show that the first two appendages behind the head are true gnathopods, like those of existing *Schizopoda*, especially *Petalophthalmus*.

There are traces of a pair of abdominal legs to each of the seven segments. To the rather

* I had regarded these appendages as breeding lamellæ, but Dr. Kingsley suggests that they are endopodites, and though the joints are very indistinct, I am disposed to accept his correction, and will speak of them as endopodites. We should, on general grounds, regard them as endopodites.

thick and long basal joint of each were probably attached two slender rami. The entire limbs were about one-half as long as the thoracic legs (see Lacoe's No. 404^{ef}). There were at least five pairs (and I think traces of a sixth) besides the last pair. The end of the abdomen, with the telson, and last pair of legs are as described and figured by Meek & Worthen. The telson is large in size, broad and short, somewhat triangular, being broader at the base than at the end. It is somewhat spatulate in form, being well rounded at the end, and much shorter than the inner rami of the appendages associated with it. Its end is fringed with coarse setæ. In the last abdominal appendages, the outer ramus is broader than the inner, with a deep longitudinal crease, or impressed line, which fades out on the outer third, or extends to the end of the basal joint. The second, or distal joint, is fringed with fine setæ. The suture between the two joints is externally indicated by two setæ larger than the others, and somewhat curved. The inner ramus is somewhat shorter than the outer; the end well rounded, and fringed with setæ. It reaches to the second joint of the longer outer ramus.

Total length of the largest specimen 33^{mm}.

Total length of the best preserved specimen 25^{mm} (Lacoe's No. 404^{ef}). This specimen gave us the following measurements:

Length of 1st antennæ (estimated) 8^{mm}.

Length of 2d antennæ (estimated) 10-11^{mm}.

Length of last thoracic leg (exopodite) 8^{mm}.

Length of endopodite 4^{mm}.

Length of telson 3^{mm}; width 1.5^{mm}.

Length of outer ramus of last pair of abdominal feet 4^{mm}.

It should be observed that the endopodites are in part represented in Meek and Worthen's figure, but not referred to in their description. They are also partly represented in their copy of Jordan and von Meyer's figure of *Gampsonyx fimbriatus*. In the latter, there is also present what is apparently a large, coarsely spined, mandibular palpus, somewhat like that in the male of the existing deep-sea Schizopod *Petalophthalmus armatus* described by Willemoes-Suhm.* In the females, however, the palpus is small and unarmed. In the figure of *Gampsonyx* referred to, the thoracic legs themselves, irrespective of the endopodites, are represented as biramous, and the two rami are drawn as of nearly equal length. It is probable that there has been a mistake in drawing the legs, as in none of the existing Schizopods, such as *Mysis* and its allies *Euphausia*, *Gnathophausia*, *Petalophthalmus* or *Chalaraspis*, are the legs thus thrice divided. It is to be hoped that the fossil itself will be examined anew with regard to this important point.†

It is sufficiently evident, however, that *Gampsonyx* and *Palæocaris* are closely allied forms, and as first suggested by Messrs. Meek and Worthen should fall into the same family, which may be called *Gampsonychidæ*. The principal character which separates this group from all other Schizopods is the entire absence of a carapace.

It is worthy of notice, however, that the size of the carapace is very variable in the Schizopods, and in the genus *Petalophthalmus* there is a great discrepancy in the two sexes. In the female it covers the entire thorax, while in the male it is remarkably small, subtriangular, leaving the two hinder thoracic segments entirely exposed, as well as the sides of the two segments in front. In the large size and oval-lanceolate shape of the endopodites, both of the gnathopods (maxillipedes) and thoracic feet, the *Gampsonychidæ* agree with *Petalophthalmus*, in which they are large and broad. In the shape of the telson and the comparative size and proportions of the last pair of abdominal appendages there is a close relationship in the *Gampsonychidæ* to the Schizopod genera *Petalophthalmus* and *Chalaraspis*, especially the latter genus, in which the telson is rounded at the end,

* On some Atlantic Crustacea from the Challenger Expedition, by Dr. R. von Willemoes-Suhm. Linnæan Transactions. Zoology, vol. i, p. 23, 1874.

† No light is thrown on the nature of the limbs by the thirty specimens of *Palæocaris scoticus* described by Mr. B. N. Peach from the lower Carboniferous rocks of Scotland. Nor were eyes with certainty detected in his specimens. "For instance, although in most of the specimens there occur small oblong bosses just in the place where their eyes should be, were they decapods, figs. 10-10d, yet the facets of the cornea have been looked for in vain. This is unfortunate, as it prevents one from saying with certainty that these are the eyes, though there is a strong presumption in favor of their being so. No sessile eyes have been observed on the carapace, neither has a trace of anything been observed that could be construed into such."—Trans. Roy. Soc. Edinburgh, 1882, p. 86.

while the two rami are more as in *Petalophthalmus*, though broader. The other biramous abdominal appendages in the Gampsonychidæ are truly schizopodal.



FIG. 3.—*Petalophthalmus armatus* ♂.

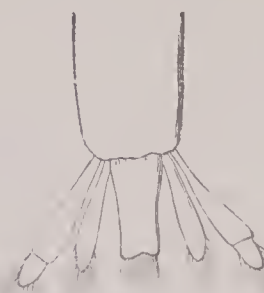


FIG. 3a.—Telson of *Petalophthalmus* ♂.

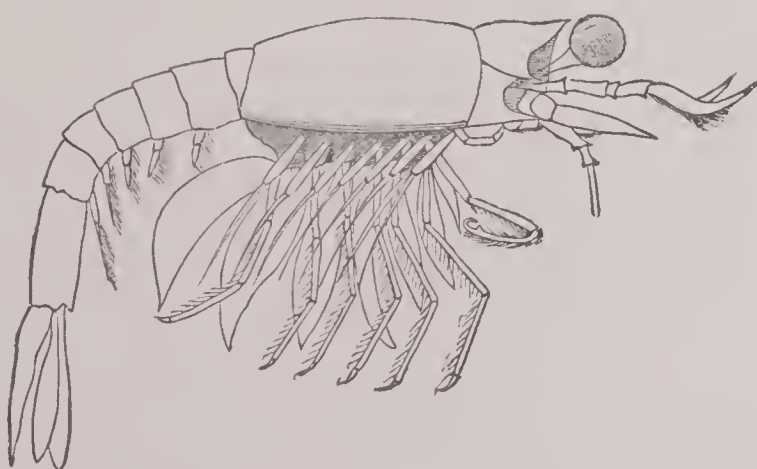


FIG. 4.—*Petalophthalmus armatus* ♀. This and Fig. 3 after W. Suhm.



FIG. 4a.—Second gnathopod of *Petalophthalmus* ♀. *l*, breeding lamella.



FIG. 4b.—Third pereopod of *Petalophthalmus* ♀.

Classifying the Schizopoda by the carapace, modifying Willemoes-Suhm's table by throwing out the Nebaliadæ and substituting the Gampsonychidæ, there would seem to be three groups, as follows :

- I. Carapace absent (Gampsonychidæ).
- II. Carapace free, varying in size..... (Gnathopansia, *Petalophthalmus* and *Chalaraspis*).
- III. Carapace fastened to the thorax (Mysis, *Lophogaster* and *Euphausia*).

But I should agree with Willemoes-Suhm that this is not a natural genealogical classification, and throwing out the Nebaliadæ, which, as we have endeavored to show, belong to a distinct order of Crustacea, the families of Schizopods may be enumerated thus (after adding the Gampsonychidæ to von Suhm's table), all having seven abdominal segments :

- Carapace absent, six pairs of thoracic legs..... I Gampsonychidæ.
- Carapace well developed, six pairs of thoracic legs..... II Mysidæ.
- Carapace well developed, eight pairs of thoracic legs..... III Euphausiidæ.
- Carapace well developed, four pairs of thoracic legs..... IV Chalaraspidæ.
- Carapace well developed, seven pairs of thoracic legs..... V Lophogastridæ.

When we compare the Gampsonychidæ with the Syncarida (*Acanthotelson*), we see that both groups have the same number of body-segments, and that both lack a carapace; and thus, while the Gampsonychidæ are the ancestors of living Schizopods, the group as a whole probably de-

scended from *Acanthotelson*, which is thus a truly synthetic form, standing in an ancestral relation to all the Thoracostraca, while it also suggests that the sessile-eyed and stalked-eyed Crustacea may have had a common parentage.

*Explanation of Plate III.**

Fig. 1. *Palæocaris typus*, M. & W. restored, enlarged four times. (The front of the head is partly conjectural and though stalked eyes probably existed, no attempt has been made to restore them.)

Fig. 2. *Palæocaris typus*, seven thoracic segments, showing the disposition of the endopodites, $\times \frac{8}{1}$ (Lacoe's 404b).

Fig. 3. *Palæocaris typus*, dorsal view of one side of three thoracic segments, showing the basal joints of the endopodites (*endop*), and exopodites (*exop*), enlarged.

Fig. 4. *Palæocaris typus*, telson and last pair of uropoda. $\times \frac{8}{1}$.

* All the figures on this plate drawn by Dr. J. S. Kingsley.

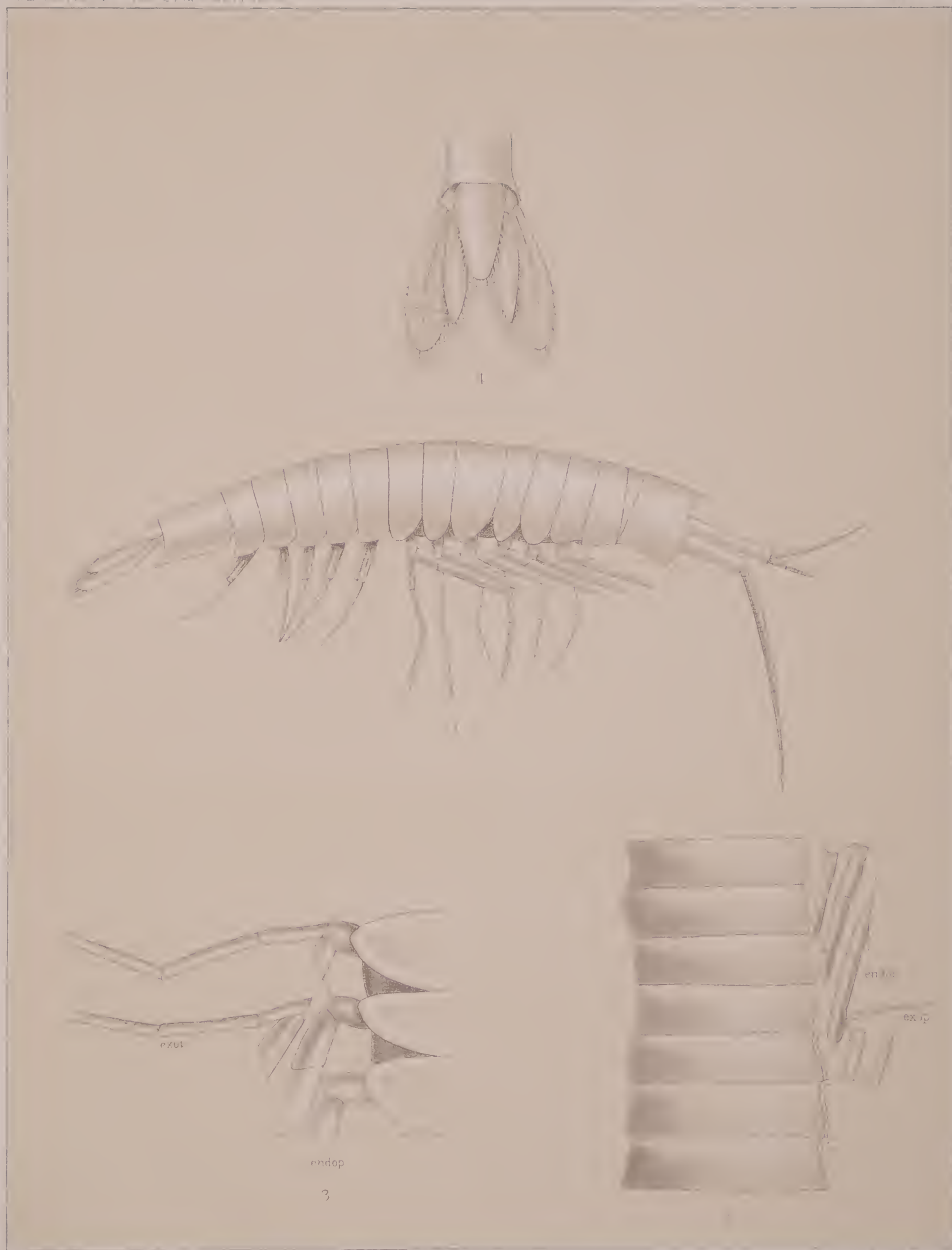


Fig. 1. Rostrum.

Fig. 2. Whole animal.

PALAEOLARI. TYPE.

III.—ON THE ANTHRACARIDÆ, A FAMILY OF CARBONIFEROUS MACROUS DECAPOD CRUSTACEA.

READ APRIL 21, 1885.

By A. S. PACKARD.

Having been kindly favored by Messrs. R. D. Lacoe and J. C. Carr with the opportunity of examining their collections of nodules from Mazon Creek containing *Anthrapalæmon gracilis* Meek and Worthen, I have been able to discover some features probably not shown in the specimens examined by Messrs. Meek and Worthen. The newly observed characters are the carapace with its rostrum, showing that the American species in these respects closely resembles the European ones figured by Salter, the founder of the genus. Moreover, our specimens prove the existence of five pairs of thoracic legs, while the antennæ of both pairs are almost entirely shown. The fact that the first pair of thoracic feet were scarcely larger than the succeeding pairs, suggests that *Anthrapalæmon* cannot be placed in the Eryonidæ, but should form the type of a distinct group of family rank, none of the existing Macrura, so far as we are aware, having such small anterior legs. Other characteristics which we shall point out confirm this view.

The genus *Anthrapalæmon*, a Carboniferous fossil, was first described by J. W. Salter in the Quarterly Journal of the Geological Society of London (xvii, 529, 1861). The name given to the fossils has, the author remarks, "only a general signification, and is not intended to indicate a real relation to *Palæmon*." He also remarks that "the genus is not to be confounded with any of the Liassic or Oolitic ones published by von Meyer, Münster, &c. . . . It is broader than the general form of the Astacidæ, or than *Glyphœa* and its Liassic allies, but much narrower than *Eryon*." Salter's type-species is *Anthrapalæmon grossarti* Salter.* With this species the American *A. gracilis* is congeneric. A closely allied English form, *A. dubius* Prestwich, is referred by Mr. Salter to the subgenus *Palæocarabus*, a name even less fitting than *Anthrapalæmon*. Concerning the other form provisionally referred to *Anthrapalæmon* by Mr. Salter (his Fig. 5), we will remark in a supplementary note to this article.

The only American species we have seen† is *Anthrapalæmon gracilis* Meek & Worthen, first described in the Proceedings of the Academy of Natural Sciences of Philadelphia, 1865, and redescribed and figured in the second volume of the Geological Survey of Illinois, and again in the third volume.

Mr. Salter figured the carapace and rostrum, as well as the abdomen of the European species; while the specimen figured by Meek and Worthen evidently did not possess the carapace, but showed perfectly the telson and neighboring pair of abdominal appendages.

The specimens loaned us by Mr. Lacoe enable us to give a more perfect description and illustrations of this important type; and I am indebted to Dr. J. S. Kingsley for the restoration and

* In his Handbuch der Palæontologie, Zittel mentions *Pseudogalathea* Peach, from the carboniferous of Scotland. We have not yet seen Mr. Peach's article.

† Dr. J. W. Dawson has described and figured, the carapace of *Anthrapalæmon hillianum*, from the Carboniferous of Nova Scotia. Geol. Mag., iv, new ser., p. 56, fig. 1, 1877. Also figured in his Acadian Geology, 1878.

details, which he has so faithfully drawn. I am inclined to think that the body was actually broader than Dr. Kingsley has drawn it, and that the lateral spines of the carapace were visible from above; but I leave it as an open question.

The carapace is of the same length as the urosome (abdomen) or slightly longer, being from two-thirds to three-fourths as wide as it is long. It is very thin and delicate, and many specimens have none. The sides are regularly curved, and unarmed behind the middle, but on the anterior third are seven distinct, sharp lateral spines, the seventh being three times as large as the others and situated on the anterior outer angle of the carapace. I cannot with certainty distinguish any spines between this last-mentioned spine and the rostrum.* Casts of the latter are distinctly seen in two specimens (Lacoe's 200pp and 200mm) to be small, triangular, short, and acute. The rostrum itself is pretty well preserved in one specimen (Mr. Lacoe's No. 200b). It is rather long, stout, strong, acute, situated between the first antennæ, and extending as far as the middle of the third joint of the scape of the latter. In another specimen (Lacoe's 200oo, 200nn) the rostrum is fairly well preserved; it is long and slender, and about half as long as the carapace; also as long as the abdomen is wide in its narrowest part.

In only a single specimen is a side view of an apparently folded carapace preserved. The entire rostrum is long and straight, slender and acute, originating in the anterior third of the carapace, the entire rostrum being about half as long as the carapace itself. (Pl. VII, figs. 3. 3a.)

Along the sides are numerous sharp spines. Whether there was, as in the other form (*A. grossarti*), a series of dorsal spines our specimens do not distinctly show. Behind the base of the rostrum a median ridge extends to the posterior edge of the carapace. The lower edge of the carapace is serrate on the anterior third, as in all the other specimens. On the surface of the carapace an apparently false or superficial suture passes out laterally from the anterior third, and another impressed line, better marked, from the posterior third, extending half-way to the edge of the carapace. The surface of the carapace is seen to be finely shagreened, but scarcely tuberculated, as in the European *A. grossarti*.

Of eyes no traces are visible in any of the specimens except one, and I am inclined to the opinion that they were either wanting or very small, and concealed under the front edge of the carapace. At the same time it should be observed that in none of the fossil macrurous Crustacea from the Carboniferous are the eyes preserved. It may also be borne in mind that in the deep-sea *Pentacheles sculptus* Smith no corneal area was to be detected, and in Willemoesia and the fossil Eryoniscens the eyes are entirely wanting.† So far as we can decide, the front edge of the carapace is not excavated at the point where we should look for eyes or eye-stalks, but, on the contrary, seems to be quite regularly convex. Still, additional specimens are needed to clear up the exact nature of the front edge of the carapace.

In most of the specimens the thin, delicate carapace has not been preserved. When it is absent the five thoracic segments are distinctly marked, of about the same length. In front of these are three cephalic segments, making eight segments in all apparent in some specimens.

The first antennæ are large and long; the scape three jointed, first joint long, the second about one-half as long as the first and of about the same width; third joint a little longer, but smaller, than the second; the two flagella are a little longer than the scape, the inner one about half as thick and evidently only half as long as the outer one. (Lacoe, No. 200ij.)

The second antennæ are, with the scape, considerably stouter than those of the first pair; first joint short and stout, but longer than broad; second very short, oblique at the end, and considerably shorter than the third joint, which is about as long as thick; the flagellum is very long and slender, multiarticulate, at least as long as the carapace, and directed backward, as in *Pentacheles*; there is an antennal scale present, but its outlines are very indistinct.

The five pairs of legs are preserved (Nos. 200pp, 200mm); they are all of nearly equal size, the first pair apparently being no larger than the others, in this respect differing from *Galathea* and the existing *Galatheidea*. Of the first pair of limbs there are in one specimen (200d) traces of nearly

* Dr. Kingsley has, however, detected a spine at this point and inserted it in his drawings, as seen in the plate.

† After this paper was written the specimens were sent to Dr. Kingsley to be drawn; among them the specimen with traces of an eye. He has drawn in the eye; and on examining the specimen again, I think that he is right in representing the eyes. It was apparently large and well developed.

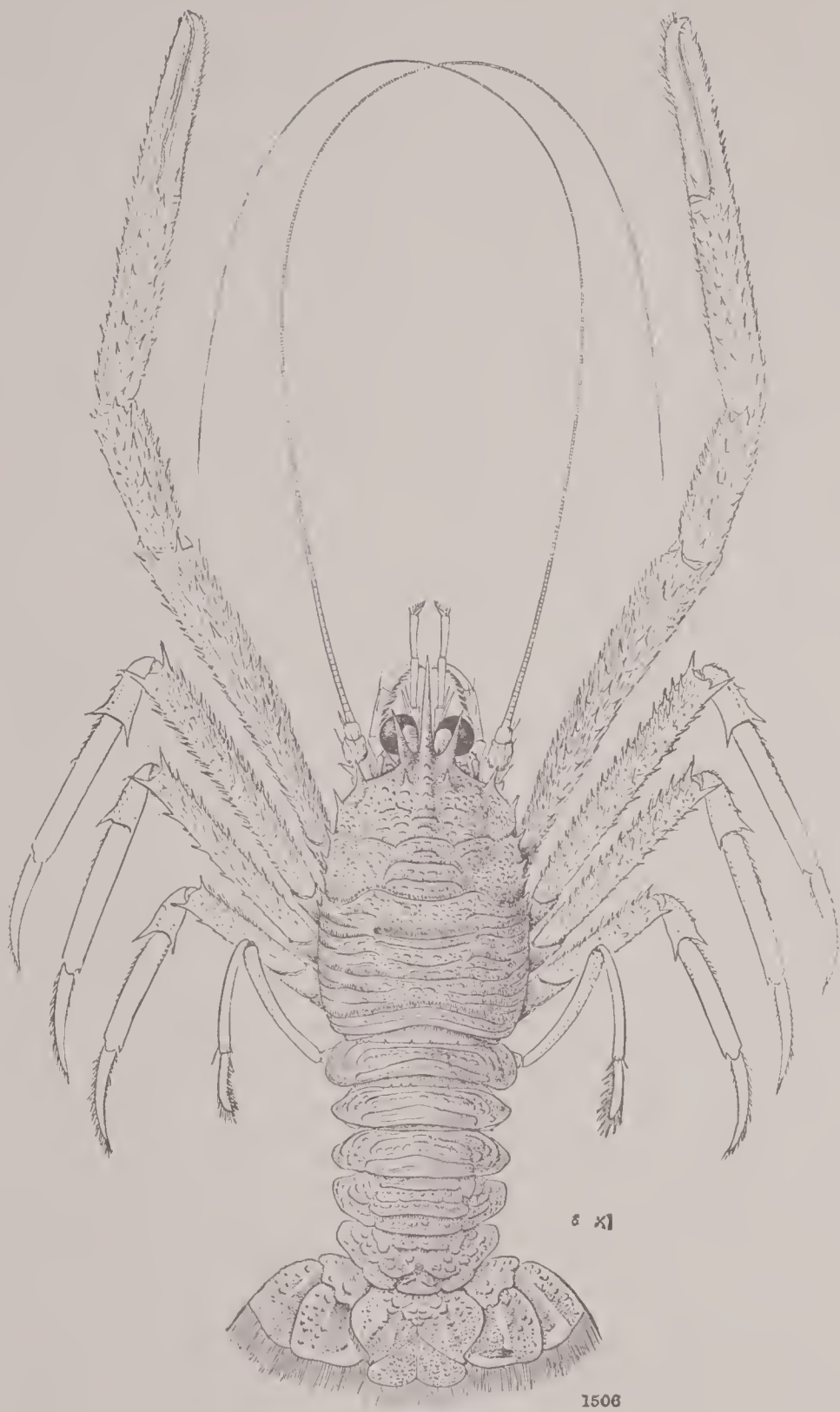


FIG. 5.—*Munida valida* Smith.

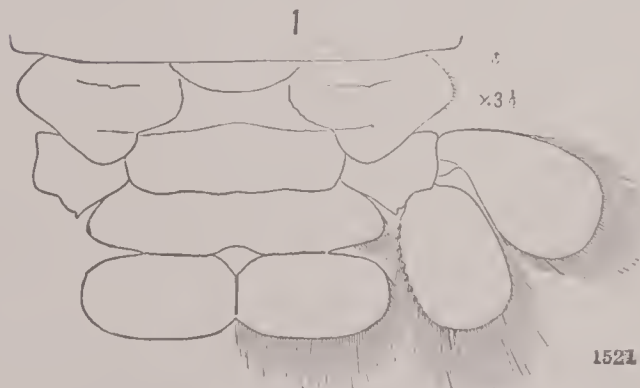


FIG. 6a.—*Eumunida picta*, end of abdomen enlarged.



FIG. 6.—*Eumunida picta* Smith.

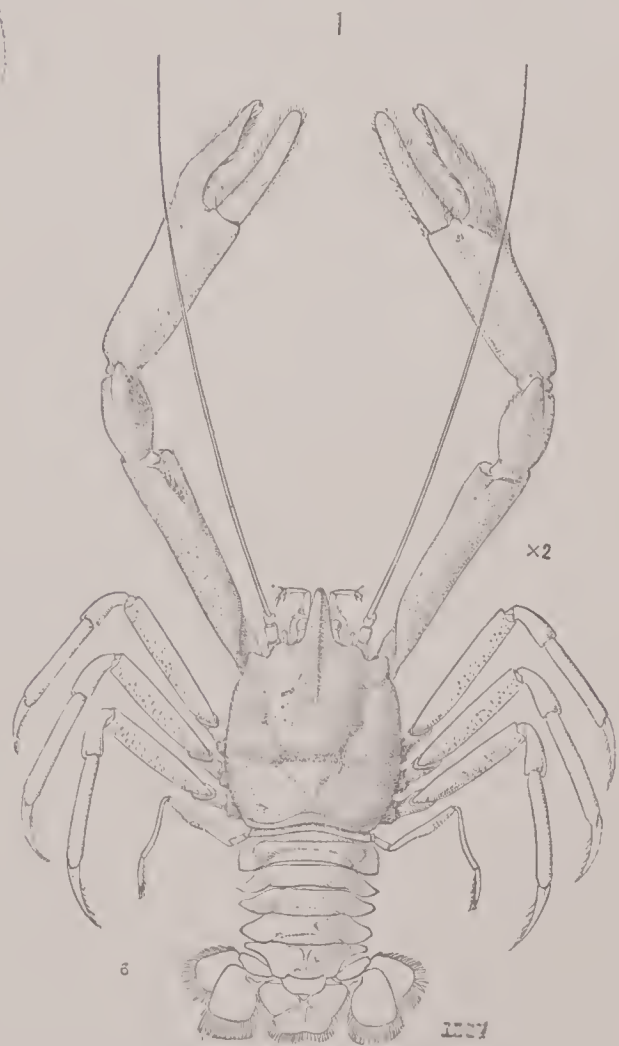


FIG. 7.—*Anoplatus olitus* Smith.

RECENT DEEP-SEA GALATHEIDEA. After S. I. Smith.

the entire limb, *i. e.*, at least the first and second joints; the third joint could not have been of large size, a feature distinguishing the Eryonidæ as well as Astacidæ and the higher Macrurans in general. The first and fifth pair seem to be of about the same size; the third and fourth pair of legs are a little larger than the others and but little longer than the width of the carapace. It is unfortunate that no specimens have yet been found with the first pair of limbs entire, but the fact that the two basal and perhaps the third joints are no larger than those of the other pairs of feet indicates that this form differed from all the fossil and recent Eryonidæ, and is a character of so much importance as to forbid our regarding Anthrapakæmon as a member of that family; the only other alternative being to consider it as a type of a distinct family. Of the four hinder pairs of legs the three terminal joints of the limbs (these affording the diagnostic characters) are preserved, and the proportions are much as in the four hinder pairs of thoracic legs of the existing deep-sea Pentacheles; of the three joints the proximal and middle ones are long and slender, the inner one longer than the outer of the two; the distal (terminal) joint is rather short and pointed, and apparently chelate. Meek and Worthen remark that the legs are not divided; whether they meant that the legs are not divided as in the Schizopoda, or simply referred to the terminal joint alone, does not appear, but in the specimen before us (No. 200pp) the last joint appears to be chelate, since what seems to be the smaller inner finger is partly but tolerably well preserved, the crust or derm itself being preserved. Yet we may be mistaken.* In Meek and Worthen's figure, the terminal joints are drawn as undivided. If this is the case, they resemble the four hinder legs of Munida, Eumunida, and Anoplotes.

The abdomen is rather short and broad, as in the Galatheidæ, and consists of seven segments, counting the telson as the seventh.

The general appearance and relative size of the telson, together with the last pair of abdominal appendages, is much as in the Eryonidæ, with some important differences. The telson, unlike that of any other Macruran, fossil or recent, so far as I am aware, is differentiated into three portions; the basal central piece is somewhat polygonal, a little longer than broad; it is separated by a distinct suture from a small triangular terminal piece which forms the apex of the telson. Between the outer half of the entire telson and the inner ramus of the uropoda is a large broad lobe which is fringed with setæ. At first I regarded it as a subdivision of the inner lobe of the last uropoda or abdominal feet, but no instance among the Decapoda is known to us in which the last pair of uropoda have more than two lobes or divisions, and I have therefore been inclined to associate the innermost of the three setiferous lobes with the telson, and to regard the telson as divided into two median and two lateral lobular setiferous portions. Whether the two lobes belong with the telson or uropoda I will leave for the present an open question. The only group in existence in which the telson is so remarkably differentiated is the Galatheidæ. In Munida the telson is divided by sutures into four pieces, the two terminal ones lobate and edged with setæ of the same size as those of the uropoda. In Eumunida of Smith the telson is "short and broad, more or less membranaceous, and divided by a transverse articulation, so that the distal part may be folded beneath the basal part." In *Anoplotes politus*, like the foregoing, a deep-sea Galatheid, "the telson is stiffened by eight distinct calcified plates; a broad median basal plate, with a small one on either side at the base of the uropod, and a small median one behind it, and between a pair of broad lateral plates, still behind which there is a second pair, which meet in the middle line and form the tips and lateral angles." Professor Smith's figures of Munida, Eumunida, and Anoplotes are here reproduced from electrotypes kindly loaned by Professor Baird, U. S. Fish Commission.†

From the nature of the differentiation of the telson in the Galatheidæ I am inclined to believe that the telson of Anthrapakæmon is subdivided in somewhat the same manner. If so, we cannot refer the genus to the Eryonidæ, and we would therefore regard it as the type of a distinct family which may thus be briefly characterized:

Family *Anthracaridæ*: Body rather broad and slightly flattened; first antennæ with two long

* In none of the six Scottish Carboniferous species of Anthrapakæmon described by Mr. B. N. Peach, do either of the thoracic limbs appear to be chelate.

† Preliminary report on the Brachyura and Anomura dredged in deep water off the south coast of New England, by the U. S. Fish Commission, in 1880. By S. I. Smith, Proc. U. S. Nat. Museum, 1883, June 18.

flagella; second antennæ long, without a scale; the first pair of thoracic legs no longer than the four succeeding pairs; the fifth pair of legs as long and well developed as the others; carapace ovate, smooth, without transverse impressed lines, with a long, acute rostrum; with lateral spines on the anterior half; abdomen rather broad, nearly as much so as the carapace; the telson broad and differentiated into two median pieces, the basal piece with broad, rounded membranaceous lobes, one on each side, fringed like the two rami of each uropod, with long setæ.

After the foregoing paper was written, and an abstract published in the *American Naturalist* for September, 1885, I sent the specimens to Dr. Kingsley to be drawn, and on their return he made the following criticisms, which are here quoted:

"From the characters shown in the specimens before me, *Anthrapalæmon* apparently has nothing to do with the Eryonidæ, but belongs rather to the Schizosomi of Stimpson. The thoracic structure, antennæ, sternum, and telson are all paralleled in that group. The telson is much like that of the Porcellain crabs. The absence of the distal pedal joints of the legs renders its family uncertain. It may belong to some of those existing in the fauna of to-day. It certainly shows no features which would justify the creation of a new family for it."

While I should hardly agree with the view that *Anthrapalæmon* belongs to the Schizosomi, since *Porcellana* is a brachyuran, with a broad, round cephalothorax and small abdomen, folded beneath the body, the differentiation of the telson is somewhat as in *Porcellana*, as will be seen by reference to Fig. 7, copied from Milne Edwards.* On the other hand, I have erred in regarding it as closely allied to the Eryonidæ, as defined by Zittel in his *Handbuch der Palæontologie*. Having already drawn attention to the highly differentiated telson of the Galatheidæ, I am now much inclined to regard the Anthracaridæ as more nearly related to this group. The resemblance to the Galatheidæ is seen in the general shape of the body, the proportions of the carapace with its sharp rostrum, and the proportions of the abdomen with its broad telson and uropoda. The first pair of antennæ differ, however, from those of the Galatheidæ in having two well-developed flagella, and the first pair of legs are much smaller, while the fifth pair are larger in proportion; the last pair of uropoda are more as in the Glyphæidæ and Astacidæ, the outer ramus being divided into a long basal and short broad distal segment.



FIG. 7.—
Abdomen
of Porcel-
lana.

It seems to us, from what we now know of the characters of *Anthrapalæmon*, as we have worked them out, that it cannot be placed in any known family of Decapoda. We should now be inclined to place the Anthracaridæ nearest the Galatheidæ, most of which are deep-sea forms. It is not improbable that they were the forerunners or ancestors of the Galatheidæ.† That the family is a synthetic group is shown by the resemblance of its telson to that of *Porcellana*, a Brachyuran. It certainly does not belong among the Palinuridæ, nor, on the other hand, among the Glyphæidæ.

In Zittel's valuable *Handbuch der Palæontologie* (Bd. 1, 2d Abth., Lief. iv, p. 682), *Anthrapalæmon* is placed among the Penæidæ, but its characters appear to be such as to forbid such an alliance. Palæontology is an inexact science, but the attempt to seek the natural position of extinct forms leads us to examine their remains more closely, to make further explorations for more perfectly preserved specimens, while the final result is to lead us to enlarge our conceptions as to the affinities of existing types of life. It seems to us better to establish new groups for Palæozoic forms of uncertain positions than to crowd them into groups of highly specialized modern forms. Yet this tendency may be carried too far. Whether we have erred in the present instance we leave to the judgment of those who, with a special knowledge of modern Crustacea, also possess both critical skill and broad views in dealing with natural groups.

NOTE ON THE PALÆOZOIC SHRIMPS (*Carididæ*).

The form provisionally referred to *Anthrapalæmon* by Salter (his fig. 5, *Quart. Journ. Geol. Soc. London*, xvii, 1861), occurring in the Carboniferous beds at Lanarkshire, Scotland, which has

* *Crustacés*, pl. 22, fig. 7.

† After writing the foregoing remarks I found I had overlooked Professor Dana's opinion, expressed on p. 350 of his *Manual of Geology*, 3d edition, where, after referring to the British species of *Anthrapalæmon*, he adds, "but the broad flattened carapax indicates a nearer relation to *Æglea* and *Galathea* than to *Palæmon*."

been copied into geological text-books as representing *Anthrapalæmon* (see Dana's Manual of Geology, fig. 686 A), does not belong to that genus or the group it represents, but is evidently one of the true shrimps or Carididæ. The carapace and serrated rostrum, as well as the shape of the abdomen, the form of the last pair of uropoda, and the telson, all indicate genuine prawn-like affinities. It may be named *Archicaris salteri*.

The other Carboniferous shrimps are *Crangopsis soliates* (Salter, Quart. Journ. Geol. Soc. 533, fig. 8, 1861). This appears to be a genuine Caridid; it is from the subcarboniferous beds of England. (As synonyms of *Crangopsis* Salter are *Palæocrangon* Salter, *non* Schauroth, and *Uronectes* Salter. (See Zittel's Palæontologie.)

Pygocephalus cooperi, of Huxley, from the Carboniferous beds near Manchester, England, is a doubtful form, which he refers "either to the decapodous or stomapodous group of the class." (Quart. Journ. Geol. Soc., xiii, 363, 1857; xviii, 420, 1862). Professor Dana (Manual of Geology, 3d edit., p. 350) regards this form as a Schizopod.

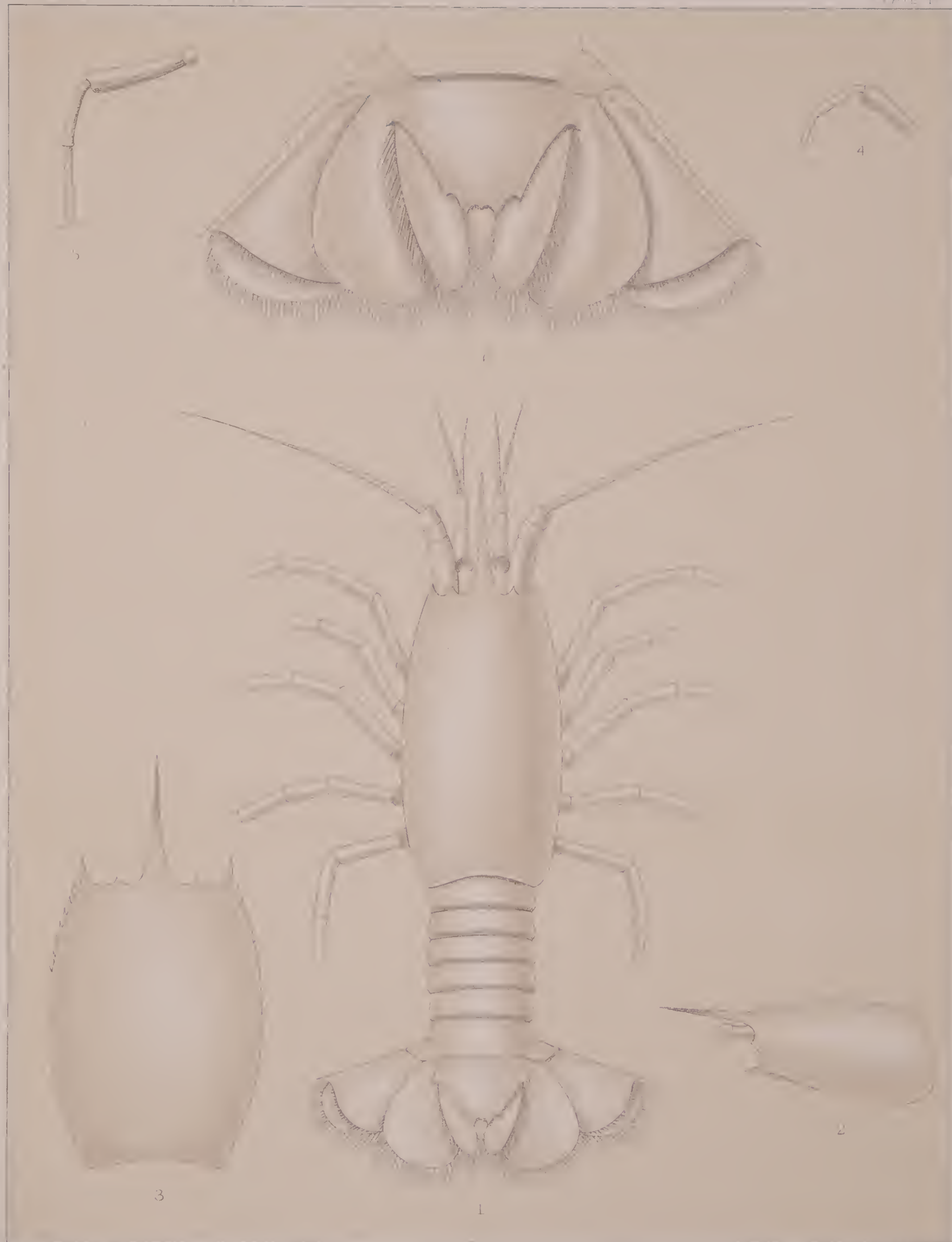
No Carboniferous Carididæ have as yet been discovered in America. The oldest known macrurous Crustacean, however, is American, the *Palæopalæmon newberryi*, described by Mr. Whitfield (Amer. Journ. Sc., 33, 1880), from the Upper Devonian of Ohio.

Explanation of Plate IV.

Fig. 1. *Anthrapalæmon gracilis*, M. & W., restored, enlarged 3 times.

- | | | | | |
|----|---|---|---|--|
| 2. | " | " | " | carapace and eyes, $\times \frac{2}{1}$. |
| 3. | " | " | " | carapace flattened, seen from above $\times 3\frac{1}{2}$. |
| 4 | " | " | " | part of first thoracic leg, $\times \frac{5}{1}$. |
| 5. | " | " | " | four basal joints of the fifth leg, $\times \frac{5}{1}$. |
| 6. | " | " | " | telson and last pair of uropoda, $\times \frac{5}{1}$ to $\frac{5}{1}$. |

All the figures on this plate drawn by Dr. J. S. Kingsley.

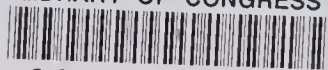


J. H. King, rev. det.

Wm. H. Smith & Co. Lith.

ANTHRAPALÆMON GRACILIS

LIBRARY OF CONGRESS



0 020 205 641 6